

An Environmental Impact Framework for Evaluating Construction Projects Delays

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Abstract

The modern business environment is operating in a highly turbulent time. Demand for operational activities to achieve effectiveness and efficiency, the environment has increased the need for organizational accountability both in private and public sectors. Meanwhile, one noteworthy gap in the management of projects is considering projects as systems existing in isolation from its surrounding environment. From an examination of the deficiencies in such an approach and how to avoid them, an understanding of the concept of the environment is very imperative. Besides, while many variables are said to cause process and system delays in construction projects, most have been conceptualized to assess aspects of project delays. However, most of these variables for assessing project delays still need improvement. This paper presents the concept of project environment, and proposes a comprehensive framework for evaluating delay sources in the external environment of construction projects through 'PESTLE' Framework Analysis namely; Political, Economic, Social, Technological, Legal and Environmental. Following the synthesis and screening of the literature review and the identified main sources, it showed that the major external sources of delays are associated with the 'PESTLE' factors. Thus, it is therefore established that 'PESTLE' framework analysis, if well understood, could be an instrumental tool for project performance assessment studies and contributes to the knowledge and practice on delay control.

Keywords

Construction, Environment, Delay, Project Performance, PESTLE

1. Introduction

The modern business environment is operating in a highly turbulent time and this has placed the construction industry in a very tenuous position. Demand for operational activities to achieve effectiveness and efficiency, the environment has increased the need for organizational accountability both in private and public sectors. The project environment in many developing and developed countries present unique challenges for projects and even human lives that almost presuppose cost and time overruns even before the commencement of a project. Time and budget are very important to the project parties. This is because any delays in the project schedule often result in time and cost overruns, lawsuits and disputes among projects parties, loss of investment, settlements and total abandonment (Aibinu and Jagboro, 2002; Sambasivan and Soon, 2007; Hannis-Ansah et al., 2015a). As a result of the superseding significance of project schedule for mainly owners and contractors; with regards to performance and budget respectively, Sorooshian (2014), in his analysis of “Delay-Based Reliability on Construction Projects”, described delays, as an extra time taking for a project to be completed as compared with the agreed completion date that was set before the start of the construction works. Delays stifle performance and growth of the construction industry. Based on research by Sorooshian (2015), the performance of construction projects in Iran was not ideal! (It was moderately acceptable only!). Many construction projects have reported delays or poor performance because of many evidential environmental specific issues ranging from political, economic through to geological conditions. There is, therefore, the need to understand the environment in which a system is running in order to formulate developmental and implementation strategies.

In 2005, Muir (2005), stated in his book “Challenges Facing Today’s Construction Manager” that, issues relating to the environment and its impacts has been on the increase since 1970’s. Environmental issues affect almost all the sectors and segments of the construction industry. He concluded that even though the environment is considered as being outside construction, there are challenges that the environment poses to managers of construction works that are regarded as being part of the business landscape and these challenges consist of; regulations from the government, legal and environmental concerns and pressures coming from the social and political factors. Outstanding managers in the construction industry understand and find a way out of these issues. These managers can handle the difficulty associated with the environment, have a competitive advantage and make the best out of risky situations. It is imperative to note that, the degree to which these forces could be identified, assessed, and evaluated by managers will have a positive or negative influence on the performance of projects.

One noteworthy gap in the management of projects has been observed to be considering projects as systems existing in isolation from its surrounding environment. From an examination of the deficiencies in such an approach and how to avoid them, an understanding of the concept of the environment is very imperative. While many variables have been found to influence the processes and systems in the construction industry, the management of the environment is deemed to be very essential to project performance. This is because failure or success often depends on variables in the environment and the degree to which these forces could be identified, assessed, and evaluated by managers will have a positive or negative influence on project performance. It is very imperative for industry’s practitioners to note that organizations do not operate in vacuum and therefore assessment of the challenges surrounding the project environment is critical for formulating and deploying developmental and environmental response strategies against the forces which inevitably impinges on its decisions, directions, actions, size, health, profitability and performance as a whole. Kuye (2004), emphasized that, the need to study business environments is very important considering the fact that business organizations do not operate in vacuum and an effective management in complex and dynamic society requires the assessment of strengths and weaknesses of the organization and the opportunities and threats provided by the challenges of the external environment, hence, for the survival and growth, organizations must cope and adapt to these challenges posed by the ever-changing environment in which managers operate. This means that managers must not only be aware of what constitutes the elements of their business environment but also should be able to respond to the forces of the environment that inevitably impinges on the operations of the business organization.

Youker (1992), described construction environment as the aggregate of surrounding things, conditions or influences. In order to avoid any problem within the construction project process, Bennett (1991), advises that, environmental factors should be a touch point in the management of construction projects. He reiterated that there is interference from the environment against the progress planned for the construction project. The term “Environment” in management does not necessarily mean physical surroundings, but, it is used as total forces, factors and influences that surround and affect business organizations as a separate entity as well as other business organizations. This means that business organizations must interact with those forces that influence its decisions, directions, actions, size, health, profitability and performance as a whole.

It is very substantive to assert that the effects of the environment on construction projects performance, project parties, human lives, infrastructural developments, governments, and the overall economy are a global phenomenon. However, the level of magnitude varies substantially across projects and geographical boundaries (Hannis-Ansah et al., 2015a). Hence, having a comprehensive understanding of the main causal variables of delays is key for empowering project parties to deploy feasible strategies to mitigate the impacts of such delays. This makes this study a very important research area for discussion as past studies have not been able to effectively address the challenges in the environment and its associated delays in the industry.

Previous studies have reported quite a number of delays in several projects with some exceeding contract duration for about days; some about year(s) and some project totally abandoned (Aibinu and Jagboro, 2002; Sambasivan and Soon, 2007). Nevertheless, according to Hannis-Ansah et al. (2015a) and Sorooshian (2014), these literature have reported delay sources without a systematic analysis and groupings. Conversely, this study categorizes all the external delay sources into fundamental groups based on their common characteristics. Also, in forming the comprehensive framework, a thorough literature review of the delay sources in the project development environment was conducted, the existing sources were identified and clustered into groupings. Following the synthesis and screening of the literature review and the identified main sources, it showed that the major external sources of delays are associated with the 'PESTLE' factors. Thus, it is therefore established that 'PESTLE' framework analysis could be an instrumental tool for project performance assessment studies and contributes to the knowledge and practice of delay control.

2. Theoretical Foundations

The external delay sources are systematically analyzed and categorized into fundamental groups known as "PESTLE" factors. PESTLE consists of political; Economic; Social; Technological; Legal and Environmental (Physical Environment) (Hannis-Ansah et al., 2015b). These variables form aspect of the external environmental analysis considered under this paper for carrying out investigations to understand the diverse variables and sub-variables in the macro environment which influence the performance of projects and cause delays (Collins, 2014; CIPD, 2015). The reason for using PESTLE is that it presents a comprehensive framework for analyzing and classifying the variables in the external environment.



Figure 1: PESTLE Framework Analysis

3. Review and Discussions

Political Sources

The construction industry is situated and operates within the covers of the political atmosphere that have restrictions and regulations. The central or local government and other semi-public departments and governmental channels play significant roles in the construction industry. Governments in almost every economy are presented as the regulators and the main clients. On the hearts of every government are initiatives, decisions, policies and schemes to stimulate,

improve or protect the economy and fulfill some specific agenda. However, these agenda may come with its own associated advantages and disadvantages on the economy. The impacts of some of these policies sometimes present a greater challenge for businesses and pose dangers to all the sectors especially the construction industry in the economy. Some of these dangers, according to Voelker et al. (2008), Al Khattab et al. (2007), Bing et al. (2005), and Ling et al. (2010), consist of: political events such as; terrorism, revolutions, wars, demonstrations and civil strifes, etc.; inactions and actions such as; nationalization and discriminatory treatments, changes in regulations, laws and policies, restrictions, bribery and corruption, expropriation, confiscation, etc.; and actions of powerful groups such as; environmental and union activism.

In 2010, a study was conducted in the construction project environment in Vietnam by Ling et al. (2010). The investigation concentrated on factors faced by international firms including; political, economic and legal, termed as PEL risk factors. Detailed questionnaires for face-to-face interviews were sent to 18 professionals who were involved in the management of construction projects in Vietnam. The professionals were from Hong Kong, Singapore, France, United States and Malaysia. The main risk factors as collated from professionals included; system administrative bureaucracy for obtaining approvals and permits, exchange fluctuation, public projects terminations, corruption, inconsistencies and changes in regulations, escalation of interest and inflation rates and poor legal framework. They concluded that the most severe risk factors encountered by international firms in order of magnitude were political, legal and economic respectively. They recommended that because of the nature of political risk, an antigraft training should be provided to the staffs who reside in Vietnam. They repeated that foreign firms should avoid projects from the public sector; bid for shorter duration projects; secure insurance for political risk, and obtain permits and approvals through local partners.

Voelker et al. (2008), said the construction industry is very sensitive to fluctuations that arise from the political environment. This is because any changes made by the government or his representative may affect estimation, budget, schedule, etc. Therefore, project teams must constantly scan the environment to understand the system and the time in which they are operating in and make arrangement to cater for any lapses that the political environment might pose. The questions that project teams should be asking here are; how and to what degree do interventions from government, interest, reaction to tax policies, corruption, inertia in government bureaucracies, environmental and labor laws, restrictions on trade, changes in taxes, increase in fuel prices, inflation, instabilities in the political system, materials scarcity, changes in government regulations and market conditions, difficulty in assessing credit facilities, just to mention a few, in the economy affect construction projects? In order to effectively address these questions, a routine industrial retrospective inspection should be undertaken by project teams, industrial practitioners, and governments to understand the eco-political (Economic and Political) dynamisms and complexities and devise corresponding strategies to deal with its aftermath.

Economic and Financial Sources

The health of every economy within which construction industries operate affect all the parties involved in the construction projects as well as demand for commercial and residential properties. This is because a healthy economy usually boosts industrial performance and subsequently, the performance of projects. Dealing with government policies whether, micro or macro in the construction process directly affect the design teams, clients, and contractors. Policy instruments concerning with the growth rate of the economy, stability or fluctuation of price, competition in the market, income distribution equality, availability of resources, import and export regulations, etc., and fiscal policy like taxation, among others, have direct or indirect consequences on the construction process. In addition, changes in the monetary policies by governments as an attempt to regulate the supply of money, exchange rates, interest policies, and supply-side policies come with benefits and disadvantages and have the potential of influencing construction projects performance. This is because, the power of these policy instruments can attract investors and boost the economy and subsequently projects performance or it may affect estimations, bring about an increase in costs for funding contracts and projects, and this may also result in abandonment of some jobs (Lingling and Hongchang, 2011).

The focus of the increasing interest in the industry should be diverted to the whole project life cycle cost, namely; initial capital costs, operating and maintenance costs and how better design and planning can be used to improve all these costs from the economy. The questions that project teams should be addressing here are; how do project teams react to changes in taxes, changes in input prices or inflation, scarcity of materials, problems with cash flow, difficulty in accessing credit facilities, changes in government regulations and changes in market conditions, just to mention a few? To answer these questions, project teams should establish an understanding of how the economic environment operates. Also, project teams must fully assess the economy and undertake financial viability studies in every

construction work. The costs associated with construction, management, design, conservation, maintenance and renovation and all that is required must be assessed because construction industries across the world inevitably work within a general economic and financial constraint environment. As a result, cost-benefit analysis and realistic budgets must be established through reliable forecasting, risk assessment and cost estimation and control.

In almost all the literature reviewed, financial difficulties in the owner's and contractor's organizations were most recorded variable for delays across national borders and across projects. Odeh and Battaineh (2002), reported that, within an unstable economic environment, it is the responsibility of project managers to guarantee the financial viability of a project. Accuracy in forecasting of the trends in both local and global economies is crucial as periodic cycles of the economy considerably shape the construction industry's activities.

Socio-cultural Sources

The socio-cultural facets of a nation or group of people must be understood by organizations that are operating within the confines of such environment. There are lots of interactions that take place between the people in the society and the organizations that undertake their activities within such society. It is, therefore, paramount that the social and cultural factors such as the rate of population growth, birth and death rate, age distribution, access to social amenities like medical care, housing, electricity, telecommunication, good road networks, be investigated. Also, the level of education and unemployment, striking, and demonstrations, the level of human rights activism, the proliferation of the mass media and its independence, crimes and other social vices, attitude to work, respect for leaders, superstitions, lifestyles, and values, among others, impact heavily on the performance of industries.

Furthermore, the demand for a company's product or service is greatly affected by the trends in the social factors. Similarly, if too many of the people are in the aging population, it signals less willing and small labor force. For instance, shortage of manpower supply may be as a result of qualified people in terms of education and experience or low workforce in the society. As the construction industries in most countries are composed of many nationals, sometimes working together, it is the responsibility of the project management team to shave and harness all these differences into an advantage. The differences may manifest in the form of communication problems, attitude to work, respect for authorities, beliefs and values, lifestyles and habits, just to mention a few, that impact negatively on project performance (Taherkhani et al., 2012; Enida and Vasilika, 2013). Muir (2005), demonstrated that there is a greater input from the community through citizenry participation in the initiation of project, design and construction. Also, there is much greater accountability to the public than in the past by today's construction manager. Pressures from the social and political environment, especially NIMBY syndrome (not in my back yard) stifles growth and development and subsequently hampers construction projects development (Muir, 2005).

Technological Sources

The environmental and ecological aspects such as research and development activities, change in technology and automation are influential to construction projects' performance as well as the whole industry. They can impact on the level of production efficiency, make communication easier and connect project teams or parties across distance and boundaries. Likewise, it can enhance effective dissemination of information through a common platform as one of the most delay sources is ineffective communication. Also, any swing in technology can adversely cause changes in quality, costs, and duration. Goodrum and Haas (2002), indicated that the level of the efficiency of construction operations today is as a result of advancement in technology. Cost reduction and operational efficiency can be achieved using advanced and mobile technologies and information technology solutions in the construction industry.

After a careful examination of 200 activities for more than 22 year period in the United States construction industry, Goodrum and Haas (2002), reported that, there have been a considerable impacts on several kinds of equipment technology that have affected the construction industry as a result 5 factors in technology; energy; information processing; control; ergonomics; and range in functionality. The construction industry's use of (i) 3D and 4D Model Application for analyzing design options/building operations, photorealistic rendering, virtual design review, estimating cost, construction operations' analyses, production of document, preparing bid package, (ii) Application of sensing technology for detecting hazards, reducing and mitigating the risks associated with the construction project, (iii) computer programs application DSS (Decision Support System), have enhanced construction project administration and conflict resolution under uncertainty.

There is no indication that technology will be stopping. This is because every day new technologies are developed to solve some of the problems the world faces. It is, however, important for project teams and industry practitioners to

constantly upgrade or update themselves and also adapt to the new technology and its revolution because technology brings enhancement and provision of tools that are vital for design and civil infrastructure works as well as managing, protecting and facilitating project teams' activities.

Legal Sources

These sources are generally the established regulations, rules and principles enacted through different legislations to control activities of companies and individuals in the society. Governments pass and enact various Legislative Acts to ensure the wellbeing of the economy, protect assets and individual rights, among others. Sometimes due to the changes in the trend of activities of individuals and organizations and the need for the government to fulfill certain political agenda in the economy, new regulations and/or changes in the existing legislative acts are effected. These regulations are becoming very complex and affecting every organization or companies in the society more directly. Martin (2003) said, there is increasingly difficulty faced by businesses today to conduct their activities without stumbling upon sets of laws and regulations. Even though, legislative instruments such as: codes of practice; environment regulations like laws for green building, pollution control, building performance, natural resource usage, building contract, energy management, etc; safety laws; antitrust laws; consumer and discrimination laws; labor and licensing regulations; laws for taxation and insurance; and others are predictable with some level accuracy, however, observations from Martin (2003) suggested that problems could occur when there are changes in taxation, industrial safety and environmental regulations during the time that project construction works are ongoing.

The effects of these laws are common, mostly during licensing, obtaining permits, designs and shop drawing approvals, contract disputes, among others. Similarly, the contractual agreement regulating scope, schedule, price, and other modes from design through to completion and maintenance have complexities that may result in disputes between clients and contractors.

A report from Moubaydeen et al. (2013) showed that Qatar's construction contracts have high risks transfer to contractors and consultants. The extent of the transferred risk is however not clear because contract amendments are poorly drafted or have some peculiar conditions. These risks are often tight deadlines and provisions for extensions are discretionary or vague. Also, in a situation where an extension is granted, they are only a liquidated damages relief, but rights for associated expenses and losses may not be allowed. Provisions for obligations on the part of the clients to approve a request or instruction are also at the discretion of the client or his engineer. Besides, contracts provide for very tight time-bar clauses for contractors to challenge clients and when contractors miss the deadline it often means no further rights. More also, requirements and specifications that have been considered within the scope of contracts are vague and are subject to instructions from the client. This makes pricing or costs very difficult because quality and time provisions are not clear in the legal conditions and terms (Moubaydeen et al., 2013). The effects of the legal environment on the performance of construction projects can never be understated and project teams are advised to navigate through these realities in order to gain competitive advantage.

Environmental Sources

The construction industry is sited within a location that has different geological and demographic features. The geological setting of a project, conditions in the ground and patterns of the weather or change in climate are some of the examples of physical environmental sources that have affected and still affecting construction project development. The unpredictable nature of most of these sources places construction industry in a tenuous position as its occurrence cannot be prevented. This situation even becomes more apparent and catastrophic in areas or geographical locations which are prone to natural disasters.

Nonetheless, Martin (2003), anticipates that management of construction works considers the significance of devising management strategies in their planning to deal with the physical effects of these sources that try to destroy resources available. He reiterated that there should be growing climate change awareness among project teams and parties, management, departments, labors, industrial practitioners, etc., on the diminishing and destructive effects presented by the physical environment on projects, infrastructures, and even human lives. Also, issues relating to air quality or ventilation, quality of water, temperature or water table (hot and cold conditions), level of noise, dust, lighting (light intensity) and its effects, health and safety, just to mention a few, have to be addressed at the various sites and project environs. These factors have strong adverse effects on the performance of construction project works. Health and safety management must be integrated into the culture of the contractor's organization and training and scrutiny must be routine at project sites, contractor's camps and facilities. This is because construction operations are usually

sensitive to climatic conditions and patterns and adverse weather such as temperature, wind, snow, humidity, rainfall, etc., can cause delays and cost overrun, mostly prompting contractors for additional budget and time claims submission. The difficulty in such claims may even result in conflict between the client and the contractor because the challenges connected with quantifying the degree at which construction delays were caused by the unfavorable climatic conditions. It was reported in Southern California that in bad weather, workers cannot always complete a task. Rather than work with low productivity, contractors prefer to delay the start of an activity until sufficient productivity can be maintained (William et al., 1992).

4. Conclusions

The identified external variables, which had been clustered into six (6) main sources (PESTLE-Political, Economic, Social, Technological, Legal, and Environmental) and their impacts on construction projects, had been evaluated and analyzed through a comprehensive literature survey by the authors. It was observed that these sources have significant effects on construction projects with regards to time and cost overruns and the overall performance of the construction industry. Even though there may be other variables or factors in the external environment that could influence project performance, however, the 'PESTLE' variables were found to be the bane for the major delay sources across projects. Meanwhile, the result of the findings from the literature survey indicated that the effects of the external environment on construction projects are a global phenomenon, however, the level of the magnitude may vary across projects and geographical boundaries. It is therefore advised that a routine industrial retrospective inspection should be undertaken by project teams, industrial practitioners, and governments, to understand the dynamisms and the complexities and devise corresponding strategies to cope and adapt to the challenges posed by the ever-changing environment in which the construction industry operate. Governments might likewise investigate the variables and create the eco-political stability that builds trust in international construction companies and other investors. It is expected that this framework and the key criteria identification will improve understandings of project teams and industry practitioners, employ as a systematic framework to categorize external delay sources in construction projects, contributes to the knowledge and practice on delay control in the construction industry and also serve as a benchmark for continuous improvements of performance of the construction industry.

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